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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/755,071

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Kie Y. Ahn

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EXAMINER

ECKERT II, GEORGE C

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 05/24/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/755,071

Applicant(s)

Ahn et al.

Examiner
George C. Eckert II

Art Unit
2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Mar 20, 2002
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28, 30-37, and 39-41 is/are pending in the application.
- 4a) Of the above, claim(s) 1-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 19-28, 30-37, and 39-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on Mar 20, 2002 is: a) ☒ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

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DETAILED ACTION

Response to Amendment

1. Applicant's amendment dated March 20, 2002 in which claims 19-25, 30-34, 39 and 40 were amended and claims 29 and 38 canceled has been entered of record.

Election/Restriction

2. Claims 1-18 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 5.

Drawings

3. The corrected or substitute drawings were received on March 21, 2002. These drawings are acceptable.

Claim Rejections - 35 U.S.C. § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

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4. Claims 19, 21, 22, 24, 25, 28, 30, 31, 33, 34, 37 and 39-41 are rejected under 35 U.S.C. 102(e) as being anticipated by US 6,362,528 to Anand. With regard to claims 19, 31 and 40, Anand teaches, with reference to figures 8-19, a dual damascene structure comprising:

- a semiconductor substrate 11;

- a first insulating layer 25 provided over the substrate;

- a metal layer 17b provided within the first insulating layer;

- at least another or second insulating layer 18 provided over the metal layer;

- a via 19a situated within the second insulating layer 18 and extending to at least a portion of the metal layer, the via being lined with a titanium-silicon-nitride layer 20a and filled with a copper material 20b (col. 13, lines 11-13 and lines 17-18);

- a third insulating layer 27 located over the second insulating layer;

- a trench 19b situated within the third insulating layer and extending to the via, the trench being lined with the titanium-silicon-nitride and filled with copper (col. 13, lines 11-13, 17-18).

With regard to claims 21, 22, 33 and 34, Anand teaches that the another or second insulating layer 18 is formed of silicon dioxide and is 1 μm or 10,000 Å thick (col. 12, lines 35-37). With regard to claims 24 and 25, Anand teaches that the third insulating layer 27 is formed of silicon dioxide and is 6,000 Å thick (col. 11, lines 41-42, lines 48-50, see also col. 11, lines 52-54). With regard to claims 28 and 37, Anand teaches that the copper material is copper (col. 13, lines 17-18). With regard to claims 30 and 39, Anand teaches that the substrate is silicon (col. 11, line 32). With regard to claim 40, Anand teaches that the integrated circuit which includes the

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dual damascene structure is formed as part of a ULSI (ultra large scale integrated circuit) which is considered a processor. Anand also teaches that the integrated circuit having the damascene layers is formed on the same chip as the processor (see generally figures 21-24).

Claim Rejections - 35 U.S.C. § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 20, 23 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand in view of US 6,093,966 to Venkatraman et al. (of record). Anand taught the device of claims 19 and 31 as discussed above but did not teach that the insulating layers may be formed of polyimide. Venkatraman et al. teach that an insulating layer may be formed of silicon dioxide or polyimide (col. 4, lines 39-54).

Anand and Venkatraman et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to use polyimide as the insulator of Anand. The motivation for doing so is that such a material has a low dielectric constant such that parasitic capacitance between conductors is reduced. Therefore, it would have been obvious to combine Anand with Venkatraman et al. to obtain the invention of claims 20, 23 and 32.

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6. Claims 26, 27, 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand as applied to claims 19 and 31 above, and further in view of *Ti-Si-N Diffusion Barriers Between Silicon and Copper* to J. S. Reid et al. Anand taught the device of claims 19 and 31 but did not teach that the Ti-Si-N liner layer is between 50 - 200 Å or specifically 100 Å thick. Reid et al. teach, on page 299 in the right hand column, first full paragraph, that a layer of Ti-Si-N may be formed at a thickness of 10 nm (100 Å).

Anand and Reid et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form the Ti-Si-N layer to a thickness of 100 Å. The motivation for doing so, as is taught by Reid et al., is that such thickness is sufficient to prevent copper migration up to a temperature of 650°C. Therefore, it would have been obvious to combine Reid et al. with Anand to obtain the invention of claims 26, 27, 35 and 36.

Response to Arguments

7. Applicant's arguments with respect to claims 19-28, 30-37 and 39-41 have been considered but are moot in view of the new grounds of rejection.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to George C. Eckert II whose telephone number is (703) 305-2752.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Eddie Lee can be reached on (703) 308-1690. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

GCE
May 21, 2002


GEORGE C. ECKERT II
PATENT EXAMINER